

Chem2110 Test 1
3 November, 2011

Time: 2 Hours

NAME: _____ **ID NUMBER:** _____

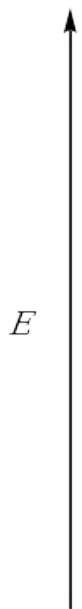
1 H 1.008																	2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226	89 Ac[†] (227)															

Question	Maximum Marks	Score
1		
2		
Total		

QUESTION 1

(a) Identify the orbitals represented by the following diagrams:

(b) Draw one simple energy level diagram that shows the subshells in the third and fourth shells of a polyelectronic atom.



(c) Complete the following statements

(i) The mathematical statement of the Heisenberg uncertainty principle is

(ii) A _____ substance is attracted to a magnetic field.

(iii) The VSEPR formulae for an angular molecular shape are

(iv) The polarity of a chemical bond depends on

(v) The value of m_l for a p_z orbital is

(vi) ψ^2 represents the

(vii) The types of hybridization for a linear molecular shape are

(viii) A multiple bond is stronger than a single bond because

(ix) $\psi_{(n, l, m_l)}$ represents

(x) The _____ of the sulfate ion has a bond order of $1\frac{1}{2}$.

(xi) The maximum number of electrons in any subshell of an atom is

(xii) The molecular shape with the VSEPR formula AB_5 has _____ 90° -angles.

(xiii) The number of _____ for any atomic orbital is given by the

the mathematical expression $n - l - 1$.

(xiv) The set of quantum numbers for the hydrogen electron are

(xv) The name of the monatomic ion with two electrons and no neutrons is

(d) Explain briefly the significance of the distance 52.92 pm from the nucleus of the hydrogen atom.

(e) Consider the cyanate ion NCO^- .

Draw all the possible Lewis structures of the cyanate ion. Which of these Lewis structures is the most important? **Why?**

(f) For each of the following substances, **draw** the **molecular shape** and **name** it. Assign the **polarity**.

(i) $\text{trans-N}_2\text{O}_2^{2-}$

(ii) the hydronium ion

(iii) XeO_2Br_2

(iv) NOF

(g) Write the chemical equation for the following reaction using **molecular shapes** of the substances.

Carbon dioxide reacts with water to form carbonic acid.

(h) (i) Se has two important acids, namely H_2SeO_4 and H_2SeO_3 .

These acids belong to a class of acids called

The name of the compound $\text{Sc}_2(\text{SeO}_3)_3 \cdot \text{H}_2\text{O}$ is

(ii) Citric acid, $\text{H}_3\text{C}_6\text{H}_5\text{O}_6$, ionizes to form the anion $\text{C}_6\text{H}_5\text{O}_6^{3-}$ called -

Citric acid contains $-\text{COOH}$ groups. Acids that contain the $-\text{COOH}$ functional group are

in the _____ called _____. The hybridization of the carbon atom in the _____ -COOH group is _____

(i) Consider the structure of progesterone, the female sex hormone and answer the questions that follow.

(i) What is the molecular formula of progesterone?

(ii) How many lone pairs of electrons does progesterone have?

(iii) How many π -bonds does progesterone have?

(iv) What are the different types of hybridization of C atoms in progesterone?

QUESTION 2

(a) Write the **name** of each of the following substances:

$\text{Na}_2\text{CO}_3 \cdot 12\text{H}_2\text{O}$

BrO

$\text{Zn}(\text{NO}_2)_2$

$\text{Mg}(\text{IO}_4)_2$

Pd^{2+}

$\text{HIO}_2(aq)$

H^+

HF(aq) _____

Au₂(CrO₄)₃ _____

Cl₂O₇ _____

³H _____

(b) Write a formula for each of the following substances:

Aluminium bicarbonate _____

Iron(III) thiocyanate _____

Ammonium hydrogen phosphate _____

Mercury(I) iodide _____

Strontium sulfide _____

Hydrocyanic acid _____

Cadmium hydrogen sulfite _____

Manganese(II) acetate tetrahydrate _____

Cesium superoxide _____

Potassium hypochlorite _____

Titanium(III) nitride _____

(c) Give the electron configuration of each of the following:

(i) The manganese(II) ion

(ii) The trivalent (+3) metal ion found in hemoglobin

(iii) The copper(I) ion

(iv) The metal ion found in bones and teeth